High-frequency surface and near-surface temperature measurements of burning composite propellants

Completed Technology Project (2017 - 2021)

Project Introduction

The current need for high-fidelity modeling to aid with solid rocket motor design requires new, more advanced characterization technologies to be developed. In this project, I propose to develop the technique of phosphor thermometry within the combustion environment of a burning composite propellant. When excited by a laser source, thermographic phosphors fluoresce. This fluorescence is temperature dependent and can therefore be exploited for thermometry. My goal is to perform in-situ 2D temperature measurements of the surface and near-surface flame structure of an AP/HTPB composite propellant. These measurements within this environment would be the first of their kind. I will use two different methods to determine temperature of these burning composite propellants, known as the lifetime and intensity ratio methods. These will be compared for their efficacy of obtaining high frequency temperature measurements within this combustion environment. The development of this characterization technique when applied to composite propellants will help achieve the goals of TA 1: Launch Propulsion Systems by providing empirical data of propulsion environments for the development of new models, in turn reducing time and costs of solid rocket motor development.

Anticipated Benefits

The development of this characterization technique when applied to composite propellants will help achieve the goals of TA 1: Launch Propulsion Systems by providing empirical data of propulsion environments for the development of new models, in turn reducing time and costs of solid rocket motor development.

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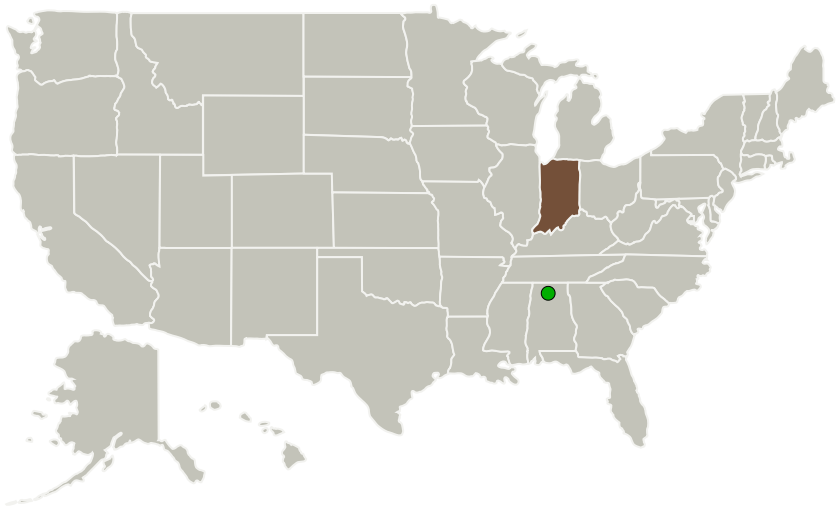
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Purdue University-Main Campus	Lead Organization	Academia	West Lafayette, Indiana
Marshall Space Flight Center(MSFC)	Supporting Organization	NASA Center	Huntsville, Alabama

Primary U.S. Work Locations
Indiana

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Purdue University-Main Campus

Responsible Program:

Space Technology Research Grants

Project Management

Program Director:

Claudia M Meyer

Program Manager:

Hung D Nguyen

Principal Investigator:

Steven Son

Co-Investigator:

Eric R Westphal

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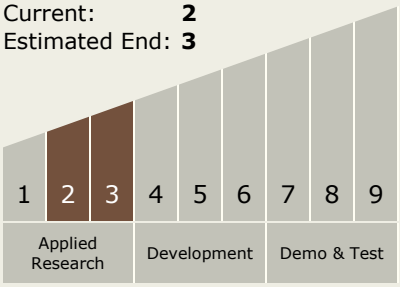
Technology Maturity (TRL)

Start: **2**
Current: **2**
Estimated End: **3**



Technology Areas

Primary:

- TX01 Propulsion Systems
  - TX01.1 Chemical Space Propulsion
    - TX01.1.4 Solids

Target Destination

Foundational Knowledge